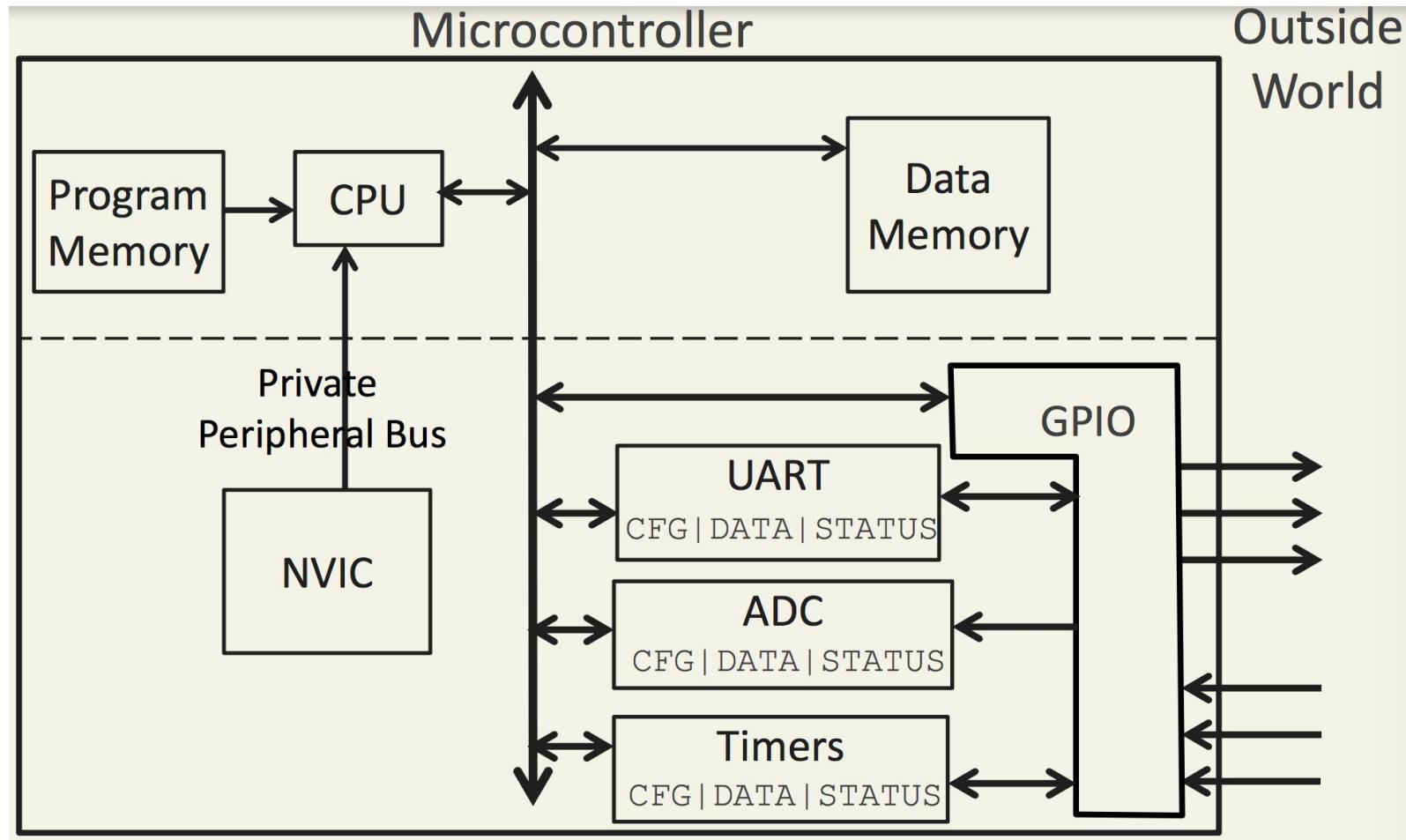
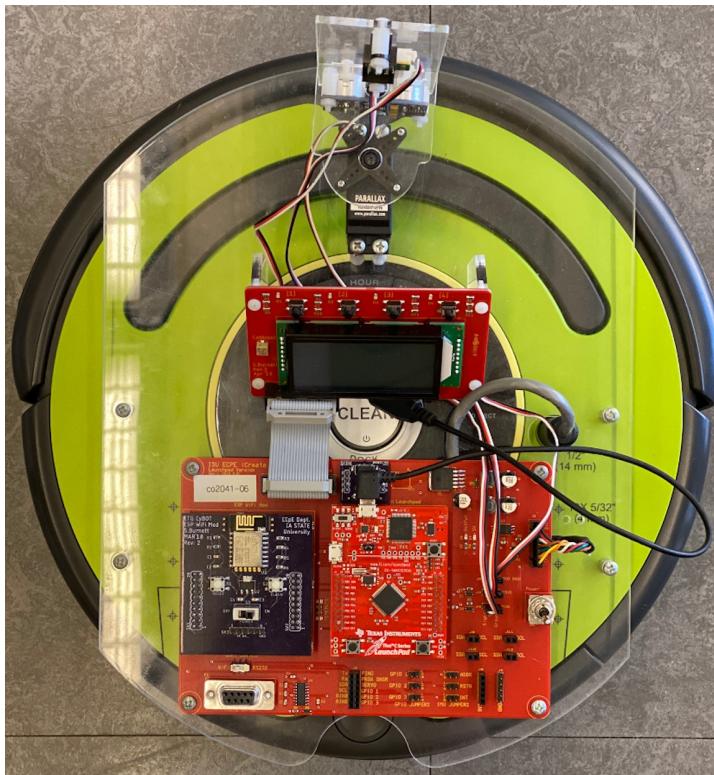


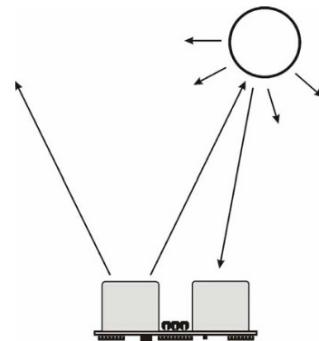
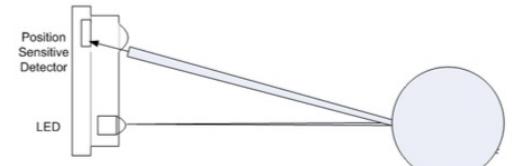
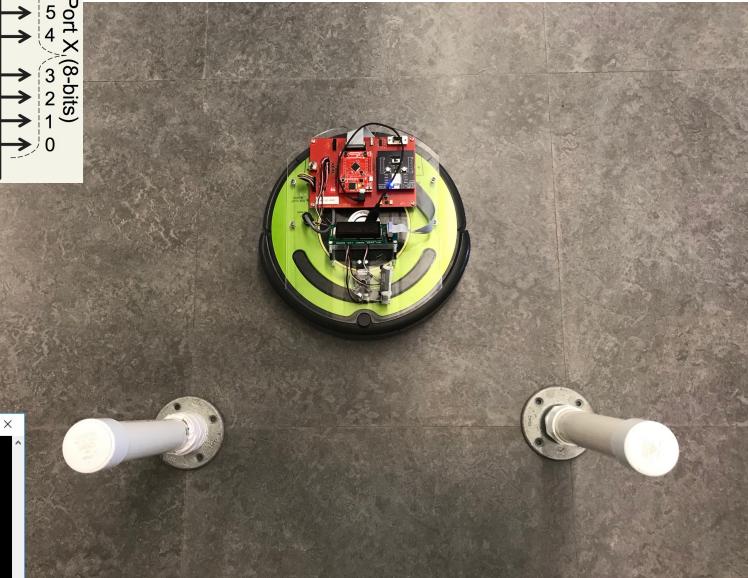
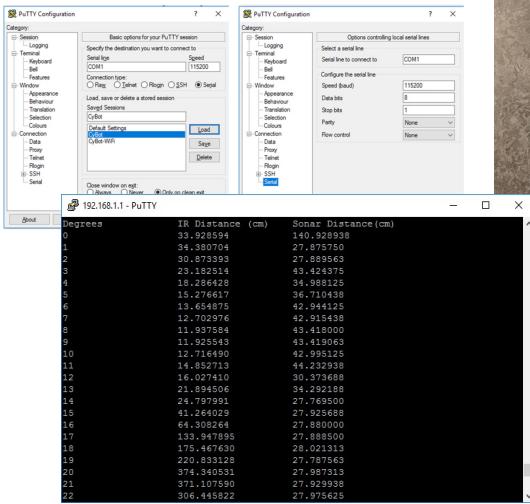
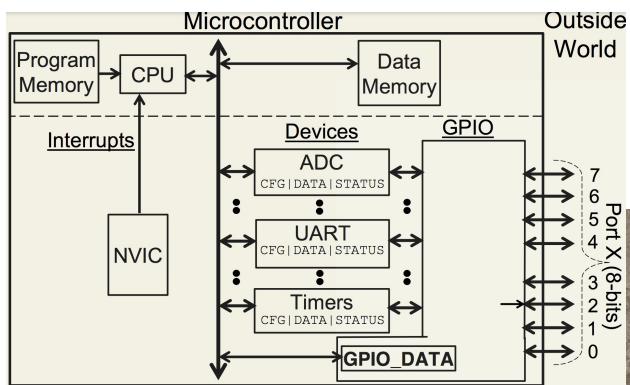
Microcontroller (TM4C123)



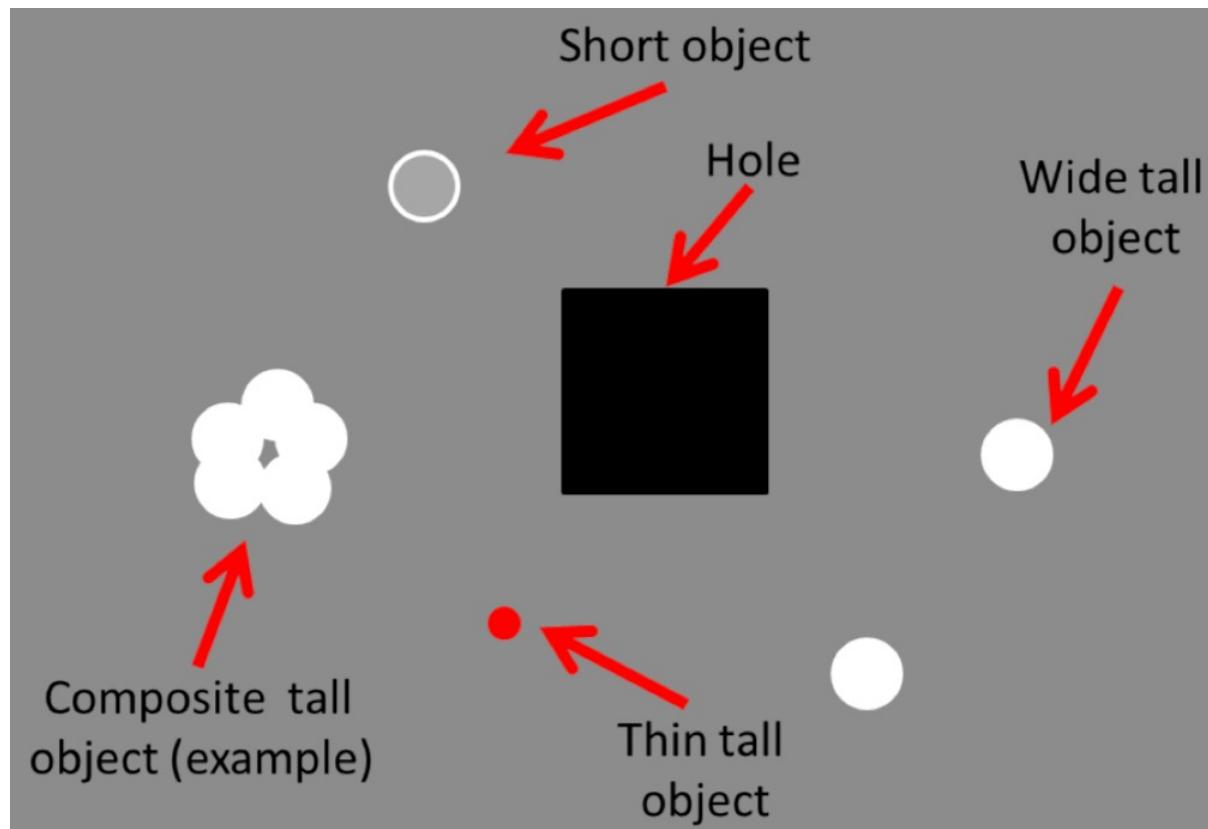
CyBot Sensors for Measuring Distance



Object Detection and Analysis



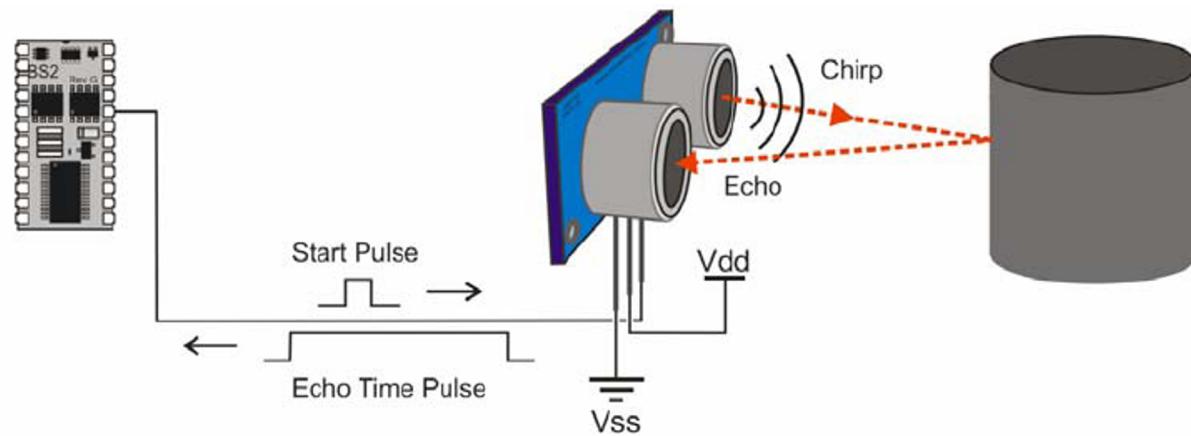
Mission 1: Drive to the smallest width object



PING))) Sensor

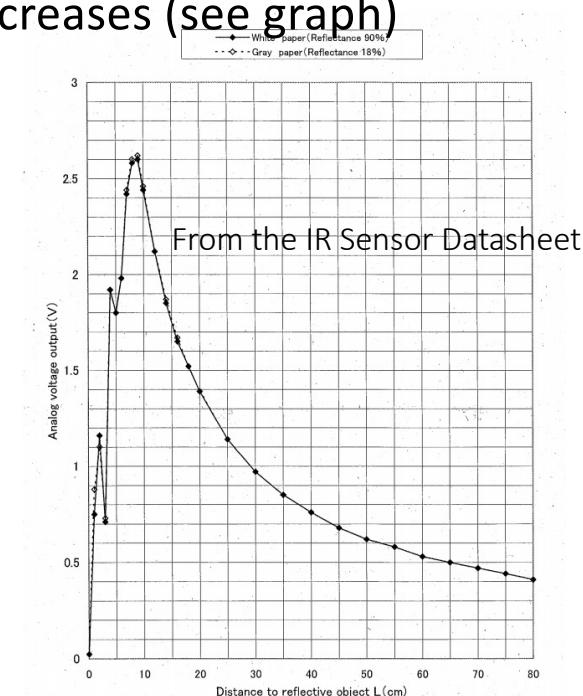
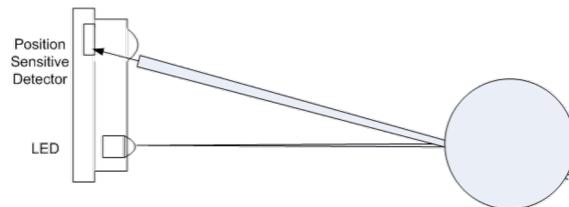
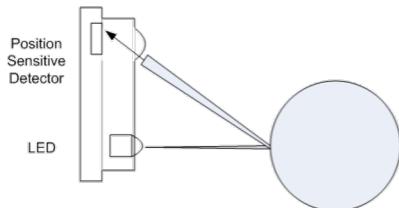


PING))) sensor: ultrasound distance detection device

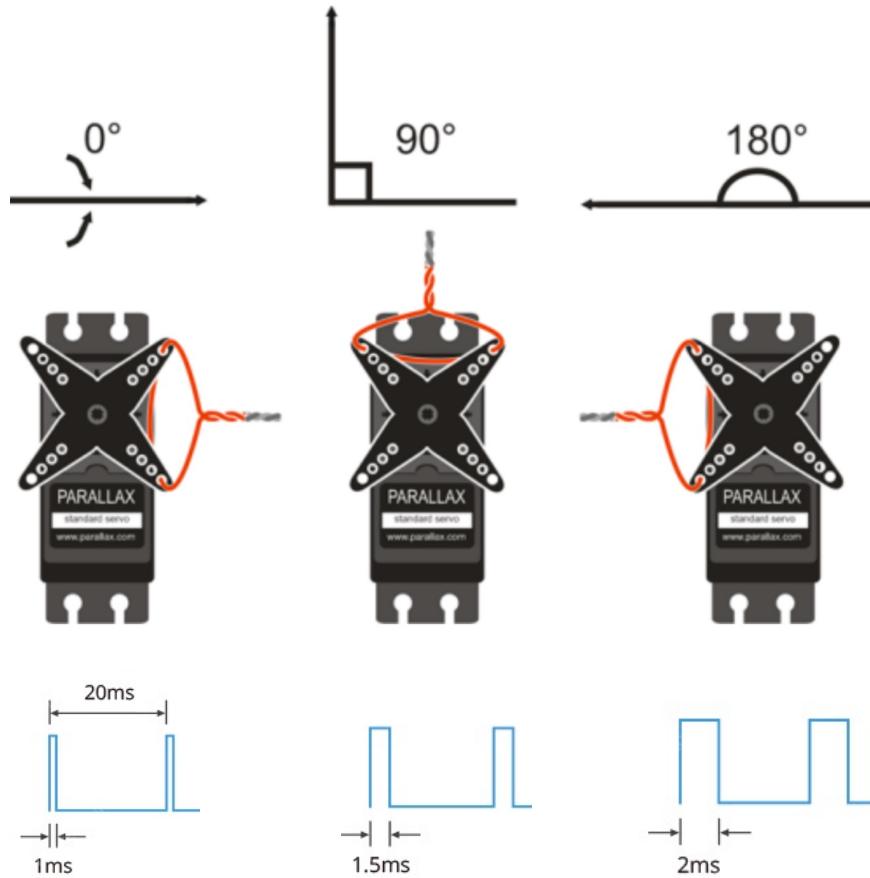


IR Sensor

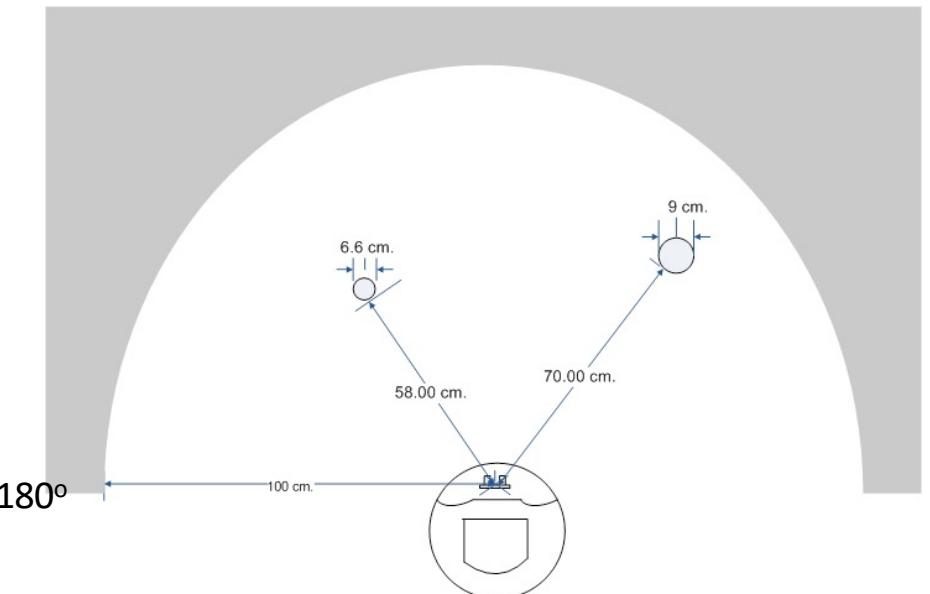
- The IR sensor emits an IR beam, and measures a voltage based on the distance of an object
 - The voltage from the IR sensor depends on the distance
 - As the distance increases, the voltage decreases (see graph)



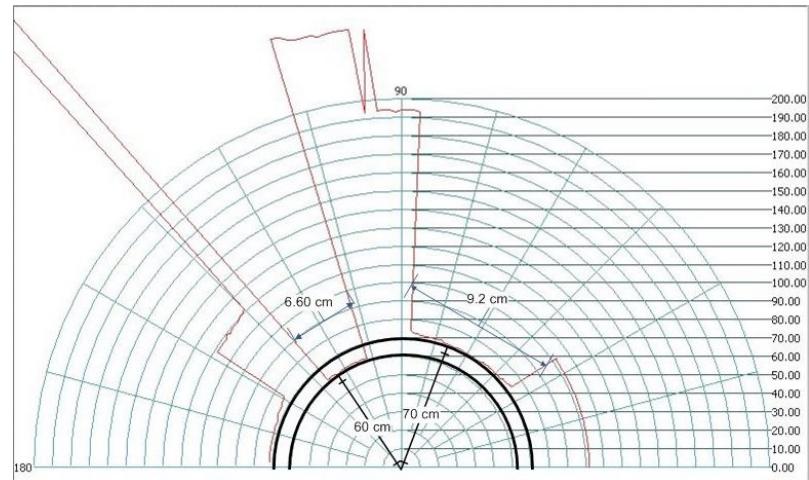
Servo Motor for Positioning the Sensors



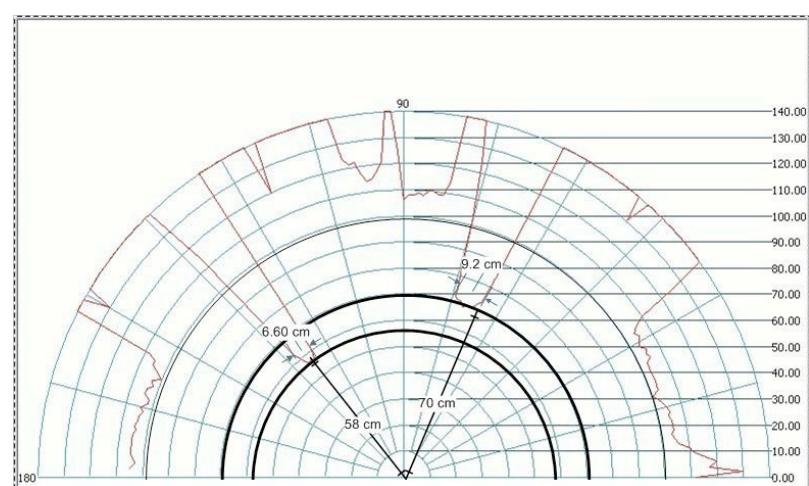
Sensor Data



PING))) Sensor



IR Sensor



Sensor Data Analysis

To detect objects for the purpose of navigation, we are interested in finding:

1. Distance to the object
2. Angular location of the object
3. Radial size of the object (the number of degrees within a sweep in which the object appears)
4. Linear width (the actual width of the object)
 - Related to the radial width, can be found using geometry or trigonometry principles. This is important since objects with the same radial width value may have different linear widths (e.g., a bigger object farther away than a smaller object)

These features are interrelated in data analysis due to the nature of the data collected as shown in the plots.

Concepts

- sensors
 - iRobot sensors
 - CyBot sensors
 - PING))) ultrasound sensor (ultrasonic or SONAR)
 - IR (infrared) sensor
- valid sensor data
- actuators, e.g., servo motor
- object detection
- object analysis (e.g., features)
- object width

Concepts (continued)

- serial communication
 - UART – Universal Asynchronous Receiver Transmitter
 - input/output (I/O) interface
 - hardware interface
 - programming interface
 - communication speed or bandwidth
 - data rate
 - bit rate (baud rate)
 - communication parameters defined/required by the UART interface
- sender and receiver
- synchronization
 - blocking or non-blocking function